

1.  $\frac{d}{dx} \cos(e^x + x) =$

(A)  $\sin(e^x + x)$

(B)  $-\sin(e^x + x)$

(C)  $(e^x + 1) \sin(e^x + x)$

(D)  $-(e^x + 1) \sin(e^x + x)$

(E) none of the above

2.  $\lim_{x \rightarrow -3} \frac{x + 3}{x^2 - 9} =$

(A)  $\frac{1}{6}$

(B)  $-\frac{1}{6}$

(C)  $\infty$

(D) 0

(E) none of the above

3. An equation of the tangent line to  $y = 3e^{x-1}$  at  $(1, 3)$  is

(A)  $y = 3x$

(B)  $y = \frac{3}{e}x$

(C)  $y = 3x - 1$

(D)  $y = 3x - e$

(E) none of the above

4. If  $g(x) = \sin(f(x) + \pi)$ ,  $f(\pi) = 0$ , and  $f'(\pi) = 2$ , then  $g'(\pi) =$

(A)  $\pi$

(B) 2

(C) 0

(D) -2

(E) none of the above

5. If  $xe^y = x - y$  then the value of  $\frac{dy}{dx}$  when  $x = 1$  and  $y = 0$  is

(A) 0

(B)  $1/2$

(C) 1

(D) 2

(E) none of the above

6. If  $f(x) = \ln(\ln(x^2 + 1))$  then  $f'(1) =$

(A)  $\ln(\ln 2)$

(B)  $\frac{2}{\ln 2}$

(C)  $\frac{1}{\ln 2}$

(D)  $\frac{1}{2\ln 2}$

(E) none of the above

7. If  $y = (\sin x)^{2x}$  then  $y' =$

(A)  $2x(\sin x)^{2x-1}$

(B)  $(\cos x)^{2x}$

(C)  $(\sin x)^{2x}(2 \ln(\sin x) + 2x \cot x)$

(D)  $(\sin x)^{2x}(2 \ln(\sin x) - \frac{2x}{\sin x})$

(E) none of the above

8. For the function  $f(x) = 2x^3 - 3x^2 - 36x$  which of the following statements is true ?

(A) 0 is the only critical number

(B) there are three critical numbers

(C) there are no critical numbers

(D) -2 and 3 are the critical numbers

(E) statements A,B,C,D are false

9. How many inflection points does the function  $f(x) = e^x - x^2$  have ?

(A) none

(B) one

(C) two

(D) three

(E) more than three

10.  $f(x) = x^4 - 2x^2 + 3$  is decreasing on the following intervals:

(A)  $(-\infty, -1)$  and  $(1, \infty)$

(B)  $(-1, 1)$

(C)  $(-\infty, -1)$  and  $(0, 1)$

(D)  $(-1, 0)$  and  $(1, \infty)$

(E) none of the above

11.  $f(x) = x^4(x - 1)^3$  has a local minimum at

(A)  $x = 0$  and  $x = 1$

(B)  $x = 0$  and  $x = \frac{4}{7}$

(C)  $x = 1$  and  $x = \frac{4}{7}$

(D)  $x = \frac{4}{7}$

(E) none of the above

12. If  $f'(x) = \ln x - 3x$  then  $f(x)$  is concave up on

(A)  $(0, \frac{1}{3})$

(B)  $(\frac{1}{3}, \infty)$

(C)  $(\frac{1}{3}, \frac{e}{3})$

(D)  $(0, \infty)$

(E) none of the above

13.  $\lim_{x \rightarrow 0} \frac{e^{5x} - 1}{\sin x} =$

(A) 5

(B) -5

(C) 0

(D) 1

(E) none of the above

14.  $\lim_{x \rightarrow \infty} \frac{\ln x}{\sqrt{x} - 1} =$

(A) 0

(B) 1

(C) 2

(D)  $\infty$

(E) none of the above

15. If  $f'(x) = \sin x + 6\sqrt{x}$  and  $f(0) = 2$ , then  $f(\pi) =$

(A)  $4\pi\sqrt{\pi} - 1$

(B)  $4\pi\sqrt{\pi} + 4$

(C)  $4\pi\sqrt{\pi} + 2$

(D)  $4\pi\sqrt{\pi}$

(E) none of the above

16.  $\sum_{i=1}^n (2i(3i + 2) + 5) =$

(A)  $n(2n^2 + 7n + 7)$

(B)  $n(2n^2 + 5n + 8)$

(C)  $n(3n^2 + 6n + 4)$

(D)  $n(3n^2 + 5n + 5)$

(E) none of the above



17. Let  $\Delta x = \frac{4}{n}$  and  $x_i = 2 + i\Delta x$ . Then  $\lim_{n \rightarrow \infty} \sum_{i=1}^n x_i \cos(1 + x_i) \Delta x =$

(A)  $\int_2^6 x \cos(1 + x) dx$

(B)  $\int_2^6 \cos(1 + x) dx$

(C)  $\int_0^4 x \cos(1 + x) dx$

(D)  $\int_0^4 \cos(1 + x) dx$

(E) none of the above

18.  $\int_{-3}^3 \sqrt{9 - x^2} dx =$

(A) 0

(B)  $\frac{9\pi}{4}$

(C)  $\frac{9\pi}{2}$

(D)  $9\pi$

(E) none of the above

19. If  $\int_0^6 f(x)dx = 5$  and  $\int_4^6 f(x)dx = -7$ , then  $\int_0^4 f(x)dx =$

(A) 12

(B) -12

(C) 2

(D) -2

(E) none of the above

20.  $\frac{d}{dx} \int_{e^x}^1 \ln t \, dt =$

(A)  $\frac{1}{x}$

(B)  $x$

(C)  $xe^x$

(D)  $-xe^x$

(E) none of the above

21. If  $f(2) = 5$ ,  $f'$  is continuous, and  $\int_2^7 f'(x)dx = 8$ , then  $f(7) =$

(A)  $-3$

(B)  $\frac{8}{5}$

(C)  $13$

(D)  $40$

(E) none of the above

22.  $\int \frac{x^2+1}{x^2} dx =$

(A)  $3\frac{\arctan x}{x^3} + C$

(B)  $\frac{x^3+3}{x^3} + C$

(C)  $x + \frac{1}{x} + C$

(D)  $x - \frac{1}{x} + C$

(E) none of the above

23.  $\int_0^1 \frac{2}{1+t^2} dt =$

(A)  $\frac{\pi}{2}$

(B)  $\pi$

(C)  $2\sqrt{2}$

(D)  $2 \ln 2 - 1$

(E) none of the above

24.  $\int_{-\pi}^{\pi} x e^{x^4+x^6} dx =$

(A)  $2e^{\pi^3+\pi^5}$

(B)  $2\pi e^{\pi^3+\pi^5}$

(C)  $\pi e^{\pi^3+\pi^5} - 2$

(D) 0

(E) none of the above

25. If  $f$  is continuous and  $\int_0^6 f(x)dx = 7$  then  $\int_0^2 f(3x)dx =$

(A)  $\frac{7}{3}$

(B) 21

(C)  $\frac{7}{2}$

(D) 14

(E) none of the above

26. A cylindrical tank with radius 4 m is being filled with water at a rate of  $3 \text{ m}^3/\text{min}$ . How fast is the height of the water increasing ?

27. Find the absolute maximum and absolute minimum values of  $f(x) = x\sqrt{4-x^2}$  on  $[-1, 2]$ .

28. If  $12 \text{ m}^2$  of material is available to make a box with a square base and an open top, find the largest possible volume of the box.

29. Find the following limits:

(a)  $\lim_{x \rightarrow 0} (1 + 3x)^{1/x}$

(b)  $\lim_{x \rightarrow 1} \left( \frac{1}{\ln x} - \frac{x}{x-1} \right)$

30. Evaluate the integrals

(a)  $\int \frac{\cos x}{(\sin x)^3} dx$

(b)  $\int_{-1}^3 x\sqrt{x+1} dx$

31. Sketch the region enclosed by  $y = (x - 2)^2$  and  $y = x$ . Find the area of this region.

32. Find the volume of the solid obtained by rotating the region bounded by  $y = \frac{x^2}{4}$  and  $y = 5 - x^2$  about the  $x$ -axis.